

**UNITED STATES DISTRICT COURT
SOUTHERN DISTRICT OF FLORIDA**

Case No. _____

SEOUL SEMICONDUCTOR CO., LTD.,
a Korean corporation; SEOUL VIOSYS CO., LTD.,
a Korean corporation,

Plaintiffs,

v.

SATCO PRODUCTS, INC.,

Defendant.

_____ /

COMPLAINT FOR PATENT INFRINGEMENT

Plaintiffs Seoul Semiconductor Co., Ltd. (“Seoul Semiconductor”) and Seoul Viosys Co., Ltd. (“Seoul Viosys”), (collectively “Plaintiffs”) for their Complaint against Defendant Satco Products, Inc. (“Satco”) allege as follows:

INTRODUCTION

1. Plaintiffs bring this patent infringement action to protect their valuable patented technology relating to light-emitting diode (LED) and LED lighting. An LED is a semiconductor device that converts electrical energy into light. LEDs have many advantages over conventional light sources, including lower energy consumption, longer lifetime, and smaller size.

2. Seoul Semiconductor was founded in 1992 with around 30 employees in a small space of a commercial building in Bongchen-dong, Seoul. From those 30 employees, Seoul Semiconductor grew into one of the largest manufacturers of LEDs in the world. Seoul Viosys is also a leading company in the LED industry and an affiliate company of Seoul Semiconductor.

3. Seoul Semiconductor's success is in large part due to its significant investment in innovation and respect for intellectual property. Seoul Semiconductor has invested in research and development ("R&D") for the last two decades. Seoul Semiconductor invests over 10% of sales revenue into R&D and owns one of the largest LED patent portfolios in the world, which includes more than 10,000 patents worldwide.

THE PARTIES

4. Plaintiff Seoul Semiconductor is a company organized and existing under the laws of the Republic of Korea, with its principal place of business at 1B-25, 727, Wonsi-dong, Danwon-gu, Ansan-city, Gyeonggi-do, Korea 425-851.

5. Plaintiff Seoul Viosys is a company organized and existing under the laws of the Republic of Korea, with its principal place of business at 65-16, Sandan-ro 163 beon-gil, Danwon-gu, Ansan-city, Gyeonggi-do, Korea 425-851.

6. On information and belief, Satco is a company organized and existing under the laws of the State of New York with its principal place of business located at 110 Heartland Blvd., Brentwood, New York 11717 and does business throughout the United States, including Florida, located at 900 N.W. 159th Drive, Miami Gardens, Florida 33169.

7. On information and belief, Satco is in the business of offering for sale, selling and distributing lighting products including light products based on LED technology.

8. Satco sells S9581, which is a filament LED incandescent lamp. An image of the S9581 is provided below.



9. Satco sells S9386, which is a PAR16 type LED lamp. An image of the S9386 is provided below.



10. Satco sells S9440, which is a PAR38 type LED lamp. An image of the PAR38 is provided below.



11. Satco sells S9782, which is a LED module. An image of the S9782 is provided below.



JURISDICTION AND VENUE

12. This is an action for patent infringement, under the patent laws of the United States, 35 U.S.C. § 271 *et seq.* This Court has subject matter jurisdiction under 28 U.S.C. §§1331 and 1338(a).

13. This Court has personal jurisdiction over Satco because, upon information and belief, Satco has committed acts of infringement within the forum state and based on systematic and continuous contact with the forum state.

14. Venue is proper within this judicial district under 28 U.S.C. § 1400 because Satco has committed acts of infringement in this judicial district and has a regular and established place of business within this judicial district.

PATENTS-IN-SUIT

15. U.S. Patent No. 8,716,946 (“the ’946 patent”) was duly and legally issued on May 6, 2014, by the United States Patent and Trademark Office to Lee *et al.* The ’946 patent is entitled “Light Emitting Device for AC Power Operation.” Seoul Viosys is the owner by assignment of the ’946 patent. A true and correct copy of the ’946 patent is attached hereto as Exhibit 1.

16. U.S. Patent No. 9,343,631 (“the ’631 patent”) was duly and legally issued on May 17, 2016, by the United States Patent and Trademark Office to Lee *et al.* The ’631 patent is entitled “Light Emitting Diode Chip Having Distributed Bragg Reflector and Method of Fabricating the Same.” Seoul Viosys is the owner by assignment of the ’631 patent. A true and correct copy of the ’631 patent is attached hereto as Exhibit 2.

17. U.S. Patent No. 8,860,331 (“the ’331 patent”) was duly and legally issued on October 14, 2014, by the United States Patent and Trademark Office to Lee *et al.* The ’331 patent is entitled “Light Emitting Device for AC Power Operation.” Seoul Viosys is the owner by assignment of the ’331 patent. A true and correct copy of the ’331 patent is attached hereto as Exhibit 3.

18. U.S. Patent No. 9,627,435 (“the ’435 patent”) was duly and legally issued on April 18, 2017, by the United States Patent and Trademark Office to Lee *et al.* The ’435 patent is entitled “Light Emitting Device.” Seoul Viosys is the owner by assignment of the ’435 patent. A true and correct copy of the ’435 patent is attached hereto as Exhibit 4.

19. U.S. Patent No. 9,716,210 (“the ’210 patent”) was duly and legally issued on July 25, 2017, by the United States Patent and Trademark Office to Kim *et al.* The ’210 patent is entitled “Light Emitting Diode and Method of Fabricating the Same.” Seoul Viosys is the owner by assignment of the ’210 patent. A true and correct copy of the ’210 patent is attached hereto as Exhibit 5.

20. U.S. Patent No. 7,667,225 (“the ’225 patent”) was duly and legally issued on February 23, 2010, by the United States Patent and Trademark Office to Lee *et al.* The ’225 patent is entitled “Light Emitting Device.” Seoul Semiconductor is the owner by assignment of the ’225 patent. A true and correct copy of the ’225 patent is attached hereto as Exhibit 6.

21. U.S. Patent No. 9,978,919 (“the ’919 patent”) was duly and legally issued on May 22, 2018, by the United States Patent and Trademark Office to Lee. The ’919 patent is entitled “Light Emitting Device.” Seoul Semiconductor is the owner by assignment of the ’919 patent. A true and correct copy of the ’919 patent is attached hereto as Exhibit 7.

22. U.S. Patent No. 10,134,967 (“the ’967 patent”) was duly and legally issued on November 20, 2018, by the United States Patent and Trademark Office to Seo *et al.* The ’967 patent is entitled “Light Emitting Device.” Seoul Semiconductor is the owner by assignment of the ’967 patent. A true and correct copy of the ’967 patent is attached hereto as Exhibit 8.

23. U.S. Patent No. 7,081,722 (“the ’722 patent”) was duly and legally issued on July 25, 2006, by the United States Patent and Trademark Office to Huynh *et al.* The ’722 patent is entitled “Light Emitting Diode Multiphase Driver Circuit and Method.” Seoul Semiconductor is the owner by assignment of the ’722 patent. A true and correct copy of the ’722 patent is attached hereto as Exhibit 9.

24. U.S. Patent No. 9,807,828 (“the ’828 patent”) was duly and legally issued on October 31, 2017, by the United States Patent and Trademark Office to Lee *et al.* The ’828 patent is entitled “Alternating Current-Driven Light Emitting Element Lighting Apparatus.” Seoul Semiconductor is the owner by assignment of the ’828 patent. A true and correct copy of the ’828 patent is attached hereto as Exhibit 10.

25. U.S. Patent No. 8,513,899 (“the ’899 patent”) was duly and legally issued on August 20, 2013, by the United States Patent and Trademark Office to Kang *et al.* The ’899 patent is entitled “Light Emitting Device and Driving Circuit Thereof.” Seoul Semiconductor is the owner by assignment of the ’899 patent. A true and correct copy of the ’828 patent is attached hereto as Exhibit 11.

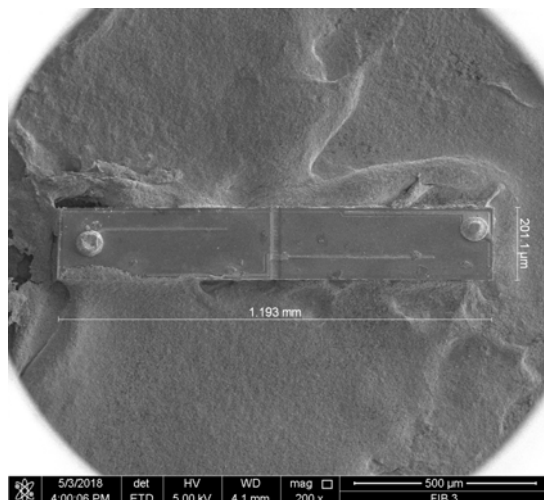
COUNT I

INFRINGEMENT OF THE ’946 PATENT

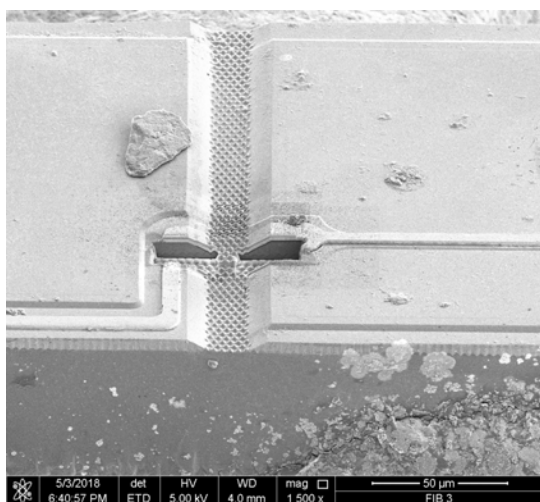
EXAMPLE CLAIM 1

26. Satco has infringed and continues to infringe one or more claims of the ’946 patent, including but not limited to exemplary claim 1, pursuant to 35 U.S.C. § 271(a), at least by without authority making, using, offering to sell and/or selling the S9581 lamp within the United States or importing the S9581 lamp into the United States.

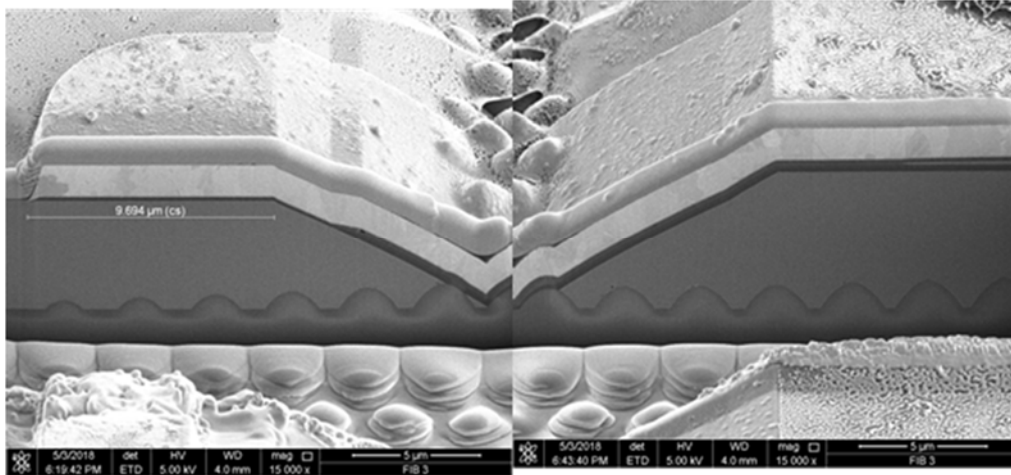
27. The S9581 lamp includes a plurality of LED filaments, each of which includes a light emitting diode chip that comprises a series connected array of light emitting cells. The array is configured to receive an input voltage to cause the cells to emit light. A scanning electron microscope image of a chip from an S9581 lamp is provided below.



28. Below is a scanning electron microscope image of a pair of holes milled into the LED chip using a focused ion beam.

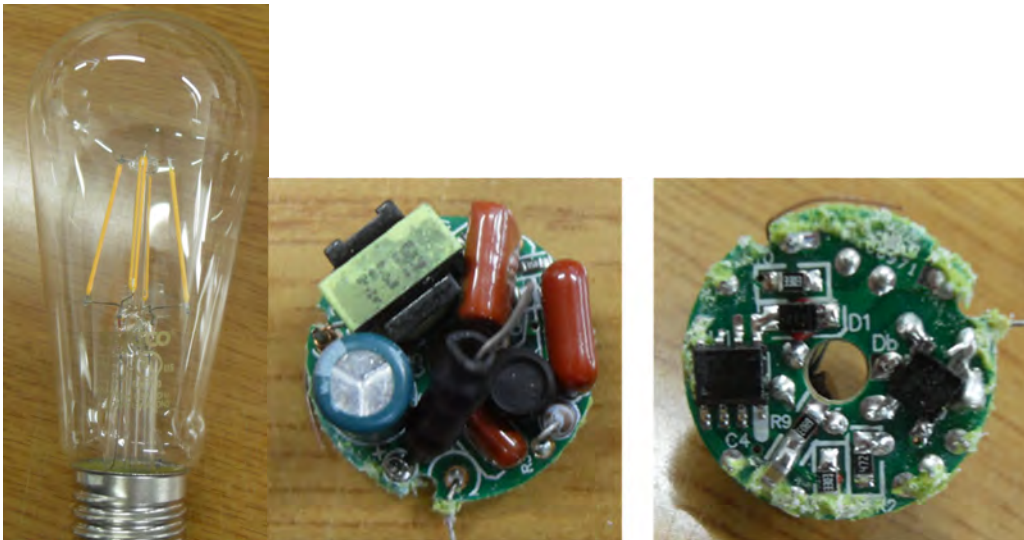


29. Below is a composite image created from scanning electron microscope images of the milled holes.



30. The bottom of the image reproduced above shows a substrate. Above the substrate are cross sectional views of portions of two of the light emitting cells, each of which includes an inclined side surface.

31. Three images are provided below. From left to right, those images are: the full S9581 lamp; a front side of the circuit board contained within the bulb; and a rear side of the circuit board contained within the bulb.



32. Two different voltages are relevant to the operation of the S9581 lamp.

33. As indicated by the bulb as depicted in the image to the left above, the S9581 lamp receives as input a wall voltage of 120V and 60Hz alternating current electricity. The reference to 60Hz indicates the periodic cycles over which the input voltage changes. During each cycle, the wall voltage includes a peak of approximately 120 volts after which the voltage falls toward zero volts.

34. Although wall voltage is received as the input to the S9581 lamp, the light emitting cells cannot be properly driven by the 120V/60Hz alternating current. The 120V/60Hz alternating current has a cyclical peak of approximately 120 volts in the forward direction, passes through zero, and then reaches a peak of approximately 120 volts in the reverse direction. The alternating current, therefore, drops below the level necessary to drive the light emitting cells after the peak of 120 volts.

35. Instead of applying the input voltage to the light emitting cells, elements on the circuit boards above center and right convert the input to DC-like power to drive the light emitting cells. The DC-like power has a cyclical voltage that varies between approximately 164.4 volts and 170.8 volts. The cyclical DC-like power causes the light emitting cells to emit light having a periodically changing luminous intensity that remains non-zero throughout the cycle of the input 120V/60Hz alternating current.

36. Satco's infringement has caused and is continuing to cause damage and irreparable injury to Plaintiffs. Plaintiffs will continue to suffer damage and irreparable injury unless and until that infringement is enjoined by this Court, as a remedy at law alone would be inadequate.

37. Upon information and belief, Satco's infringement has occurred with knowledge of the '946 patent and knowledge that its acts constitute infringement. Satco's continuing conduct, therefore, is willful.

38. Plaintiffs are entitled to injunctive relief and damages in accordance with 35 U.S.C. §§ 271, 281, 283, and 284.

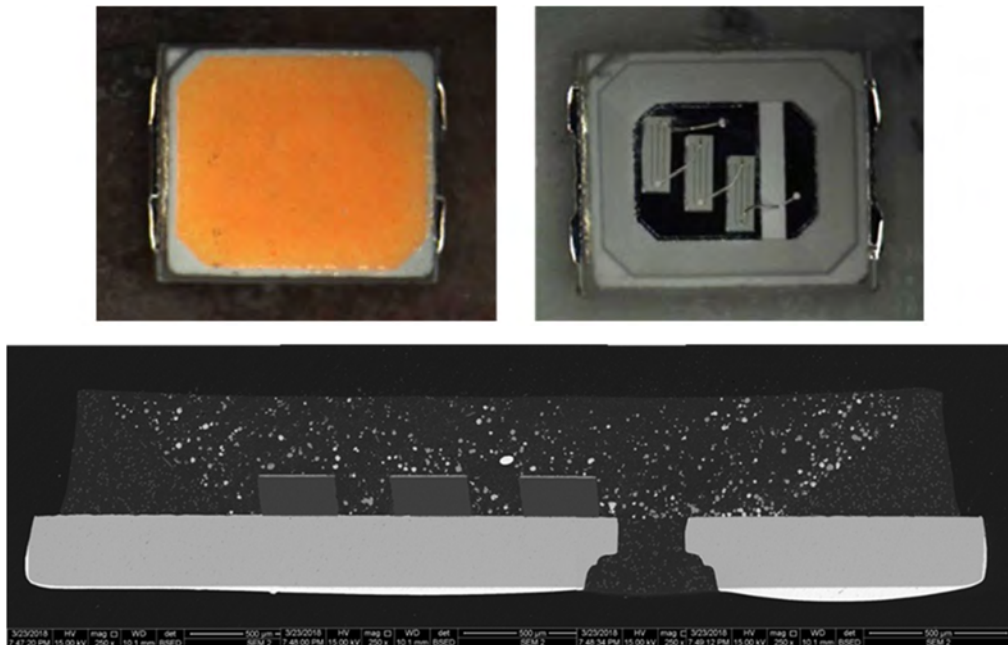
COUNT II

INFRINGEMENT OF THE '631 PATENT

EXAMPLE CLAIM 1

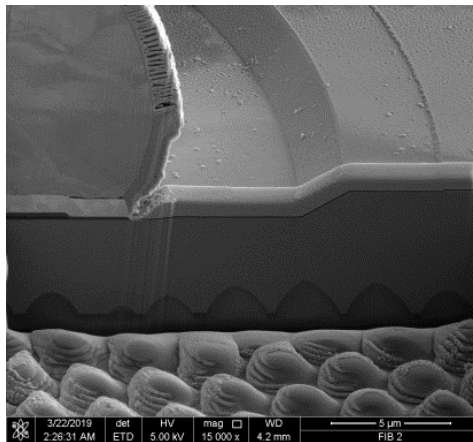
39. Satco has infringed and continues to infringe one or more claims of the '631 patent, including but not limited to exemplary claim 1, pursuant to 35 U.S.C. § 271(a), at least by without authority making, using, offering to sell and/or selling the S9386 lamp within the United States or importing the S9386 lamp into the United States.

40. The S9386 lamp includes a plurality of LED packages, each of which includes a light emitting diode chip. Three images of a package from an S9386 lamp are reproduced below. The image below left shows the package after removal from the S9386 lamp. The image below right shows the package after removal of the resin encapsulant. The image at bottom shows a scanning electron microscope image of a cross-section through the package.



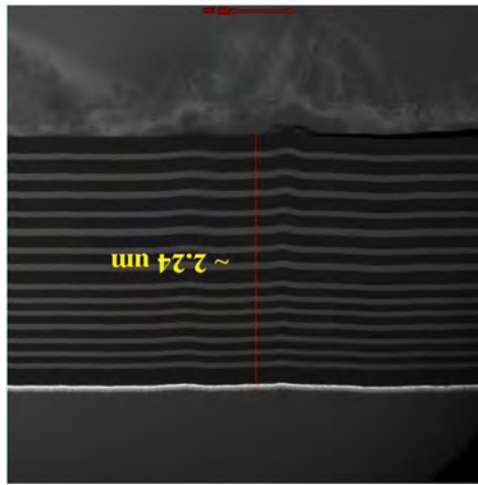
41. The cross-section image above show the LED covered by a member comprised of resin. The resin member contains phosphor particles, which can be seen as relatively bright spots within the darker resin.

42. Below is a scanning electron microscope image of the side surface of a hole created using a focused ion beam in one of the LEDs from the S9386 lamp. The image shows the epi-structure formed above a patterned sapphire substrate. The epi-structure comprises a light-emitting structure including from bottom to top, a portion of the n-type semiconductor layer, a multi-quantum well active layer, and a p-type semiconductor layer. The multi-quantum well active layer emits light in the shorter blue wavelength range. The above-described phosphor converts a portion of the emitted light to a longer wavelength.



43. The transmission electron microscope image below shows a portion of the distributed Bragg reflector located on the bottom of the substrate. As shown in the below image, the distributed Bragg reflector (“DBR”) comprises two portions, an upper portion closer to the substrate comprising relatively thick layers of SiO₂ and TiO₂ and a lower portion further from the substrate comprising relatively thin layers of SiO₂ and TiO₂. The relatively dark layers comprise SiO₂ and the relatively bright layers comprise TiO₂. The lower DBR provides higher reflectivity for the shorter wavelength blue light emitted by the light emitting structure. The upper DBR provides higher reflectivity for the longer wavelength light converted by the phosphor.

44. Satco’s infringement has caused and is continuing to cause damage and irreparable



injury to Plaintiffs. Plaintiffs will continue to suffer damage and irreparable injury unless and until that infringement is enjoined by this Court, as a remedy at law alone would be inadequate.

45. Plaintiffs are entitled to injunctive relief and damages in accordance with 35 U.S.C. §§ 271, 281, 283, and 284.

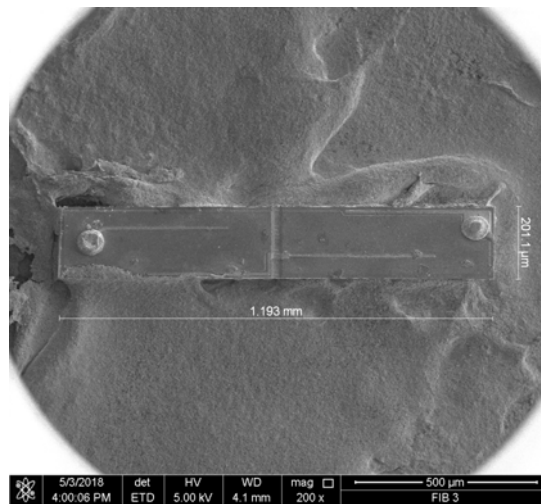
COUNT III

INFRINGEMENT OF THE '331 PATENT

EXAMPLE CLAIM 11

46. Satco has infringed and continues to infringe one or more claims of the '331 patent, including but not limited to claim 11, pursuant to 35 U.S.C. § 271(a) at least by without authority making, using, offering to sell and/or selling the S9581 lamp within the United States or importing the S9581 lamp into the United States.

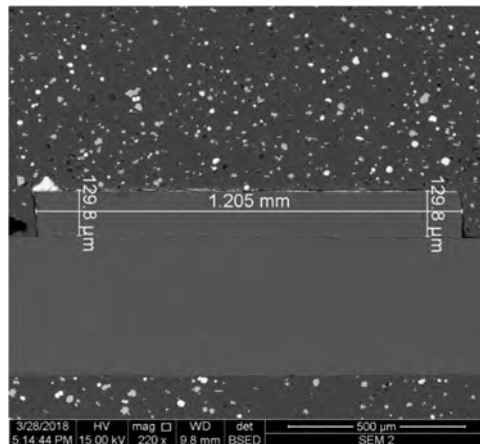
47. The S9581 lamp includes a plurality of LED filaments, each of which includes an LED chip that comprises a plurality of light emitting cells connected in series. A scanning electron microscope image of an LED chip from an S9581 lamp is reproduced below.



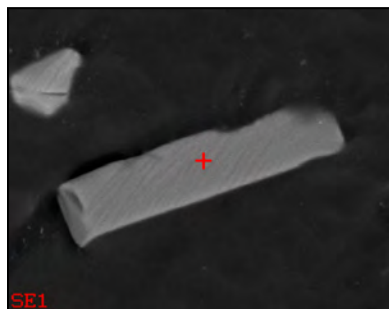
48. Below is an optical microscope image of a cross section through an example LED filament from the S9581 lamp. The optical image shows a transparent member made of resin covering the LED chip.



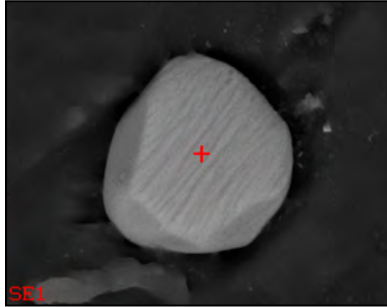
49. Below is a scanning electron microscope image of a portion of the transparent member from the S9581 lamp. The image shows two different types of phosphors.



50. An example particle of a first phosphor, which generally have a relatively elongated shape and possess a relatively long decay time when excited by light from the LED chip, is depicted below.



51. An example particle of a second phosphor, which generally have a relatively circular shape and possess a relatively short decay time when excited by light from the LED chip, is depicted below.



52. Both types of phosphor emit light within the visible range when excited by light from the LED chip.

53. Satco's infringement has caused and is continuing to cause damage and irreparable injury to Plaintiffs. Plaintiffs will continue to suffer damage and irreparable injury unless and until that infringement is enjoined by this Court, as a remedy at law alone would be inadequate.

54. Upon information and belief, Satco's infringement has occurred with knowledge of the '331 patent and knowledge that its acts constitute infringement. Satco's continuing conduct, therefore, is willful.

55. Plaintiffs are entitled to injunctive relief and damages in accordance with 35 U.S.C. §§ 271, 281, 283, and 284.

COUNT IV

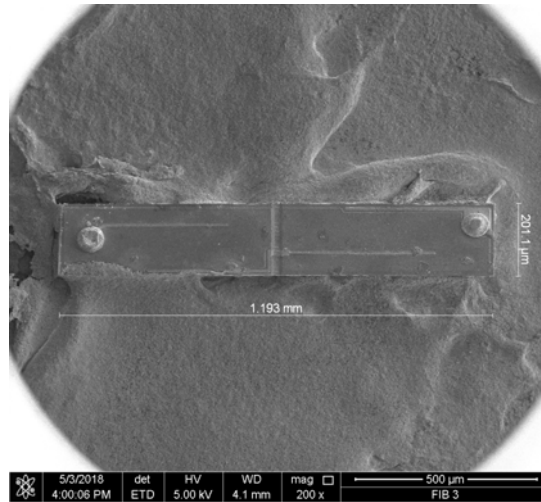
INFRINGEMENT OF THE '435 PATENT

EXAMPLE CLAIM 1

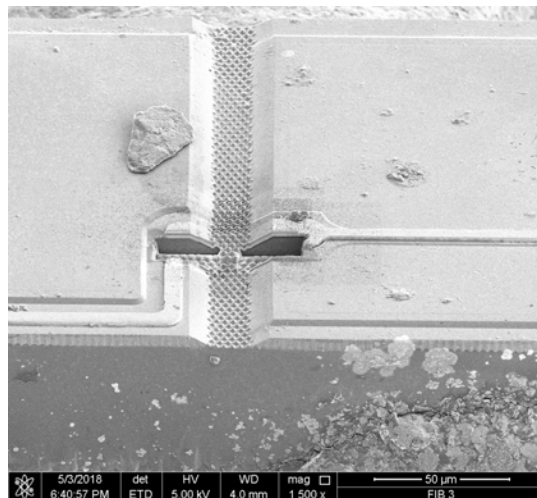
56. Satco has infringed and continues to infringe one or more claims of the '435 patent, including but not limited to exemplary claim 1, pursuant to 35 U.S.C. § 271(a) at least by without

authority making, using, offering to sell, and/or selling the S9581 lamp within the United States or importing the S9581 lamp into the United States.

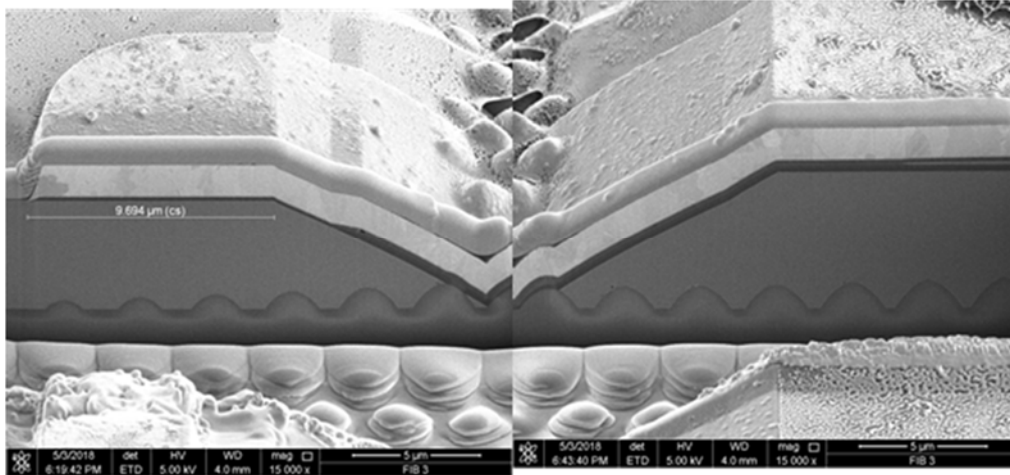
57. The S9581 lamp includes a plurality of LED filaments, each of which includes a light emitting diode chip that comprises light emitting cells. A scanning electron microscope image of a chip from the S9581 lamp is reproduced below.



58. Below is a scanning electron microscope image of a pair of holes milled into the LED chip using a focused ion beam.



59. Below is a composite image created from scanning electron microscope images of the milled holes.



60. The bottom of the image reproduced above shows a substrate. Above the substrate are cross sectional views of portions of two of the light emitting cells.

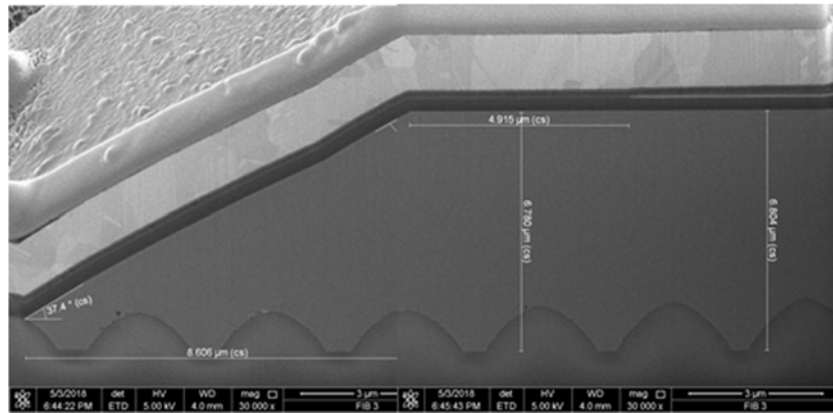
61. Both of the light emitting cells include first and second semiconductor layers with an active layer disposed between them. The upper semiconductor layer comprises a p-type layer and the lower semiconductor layer comprises an n-type layer.

62. In addition, the light emitting cell on the right side of the image includes a continuous inclined surface having a slope between 20° and 80° from a horizontal plane of the substrate.

63. The light emitting cell on the right includes at least two conductive materials, including a metallic conductor and a transparent layer of indium tin oxide (ITO). At least one of those conductive materials is disposed on the upper p-type semiconductor layer of the cell on the right. And at least the other of those conductive materials electrically connects the light emitting cells.

64. Below is a composite image created from scanning electron microscope images of the milled hole in the light emitting cell on the right side of the image above. In this image, the ITO layer is shown as a relatively thin and bright line above the upper p-type semiconductor layer.

The ITO layer extends horizontally from the right edge of the image. In this image, the metallic conductor is shown as including a relatively thick and bright layer above the upper p-type semiconductor that extends from the right side of the image to the left side of the image.



65. The cell on the right in the cross-sectional image above also includes at least two insulation layers. For example, portions of a pair of light-transmitting silicon dioxide (SiO_2) layers are shown as relatively dark layers in the cross-sectional image. At least one of the SiO_2 layers overlaps one of the conductive materials and both light emitting cells. And at least the other of the SiO_2 layers overlaps the other of the conductive materials.

66. Satco's infringement has caused and is continuing to cause damage and irreparable injury to Plaintiffs. Plaintiffs will continue to suffer damage and irreparable injury unless and until that infringement is enjoined by this Court, as a remedy at law alone would be inadequate.

67. Upon information and belief, Satco's infringement has occurred with knowledge of the '435 patent and knowledge that its acts constitute infringement. Satco's continuing conduct, therefore, is willful.

68. Plaintiffs are entitled to injunctive relief and damages in accordance with 35 U.S.C. §§ 271, 281, 283, and 284.

COUNT V

INFRINGEMENT OF THE '210 PATENT

EXAMPLE CLAIM 1

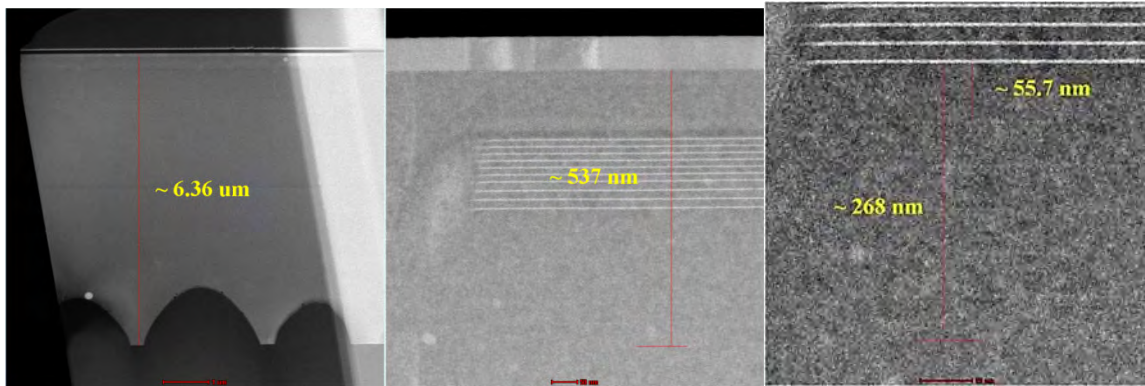
69. Satco has infringed and continues to infringe one or more claims of the '210 patent, including but not limited to claim 1, pursuant to 35 U.S.C. § 271(a) at least by without authority offering to sell and/or selling the S9386 lamp within the United States or importing the S9386 lamp into the United States.

70. The S9386 lamp includes a plurality of LED packages, each of which includes a light emitting diode. The image of an LED package from an S9386 lamp are reproduced below left. The image below right shows LED chips within package.



71. Below are three transmission electron microscope images of the epi-structure of the LED chip. The image to the left shows the entire epi-structure above a patterned sapphire substrate. The image below middle enlarges the region of the epi-structure around the multi-quantum well active layer. The image below right enlarges the region under the active region. The epi-structure includes from top to bottom in relevant part a p-type contact layer, a multi-quantum well active region, and an n-type contact layer. The active region, which appears as a relatively bright repeating pattern of Indium doped layers separated by relatively dark barrier layers near the center of the image. Below the active region is a superlattice layer, which includes a plurality of layers,

and appears as a relatively faint and closely spaced pattern. Below the superlattice is a spacer layer, which includes a plurality of layers, and appears as a relatively faint and widely spaced pattern.



72. Based on the level of Indium doping in the active region, the superlattice layer, and the spacer layer, the spacer layer will have a bandgap smaller than the barrier layers of the multi-quantum well, but higher than the bandgap of the quantum well layers.

73. Satco's infringement has caused and is continuing to cause damage and irreparable injury to Plaintiffs. Plaintiffs will continue to suffer damage and irreparable injury unless and until that infringement is enjoined by this Court, as a remedy at law alone would be inadequate.

74. Plaintiffs are entitled to injunctive relief and damages in accordance with 35 U.S.C. §§ 271, 281, 283, and 284.

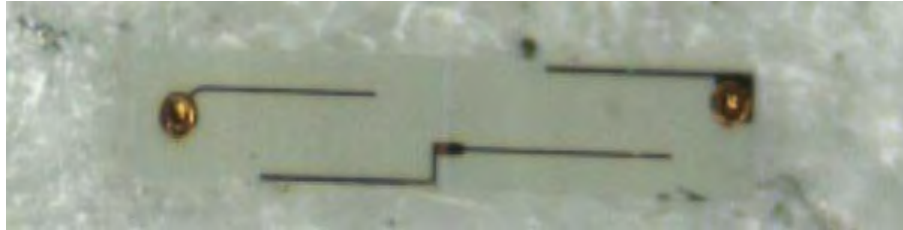
COUNT VI

INFRINGEMENT OF THE '225 PATENT

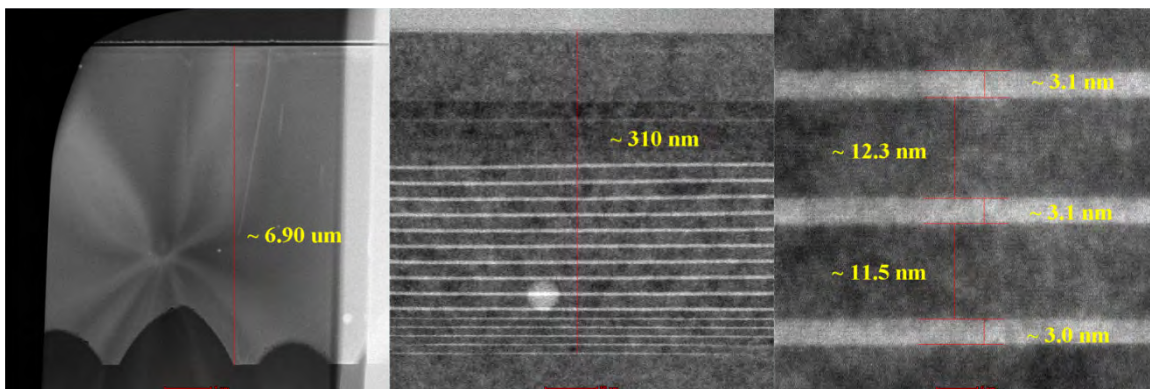
EXAMPLE CLAIM 1

75. Satco has infringed and continues to infringe one or more claims of the '225 patent, including but not limited to claim 1, pursuant to 35 U.S.C. § 271(a) at least by without authority offering to sell and/or selling the S9581 lamp within the United States or importing the S9581 lamp into the United States.

76. The S9581 lamp includes a plurality of LEDs. An optical image of an LED from an S9386 lamp is reproduced below.



77. Below are three transmission electron microscope images of the epi-structure of the LED chip. The image to the left shows the entire epi-structure above a patterned sapphire substrate. The image below middle enlarges the region of the epi-structure around the multi-quantum well active layer. The image below right enlarges a portion of the multi-quantum well. The LED includes from bottom to top in relevant part a substrate, an n-type semiconductor layer, a multi-quantum well structure, and a p-type semiconductor layer. The multi-quantum well structure comprises brightly colored wells separated by darker barriers.



78. The well layers within the multi-quantum well include indium. In addition, the concentration of indium varies across the layer, with areas of relatively high indium concentration transitioning to areas of lower indium concentration. The regions of relatively higher indium concentration correspond to carrier trap portions. And the transition from relatively lower to relatively higher indium concentration corresponds to a related drop in the band-gap energy.

79. Satco's infringement has caused and is continuing to cause damage and irreparable injury to Plaintiffs. Plaintiffs will continue to suffer damage and irreparable injury unless and until that infringement is enjoined by this Court, as a remedy at law alone would be inadequate.

80. Plaintiffs are entitled to injunctive relief and damages in accordance with 35 U.S.C. §§ 271, 281, 283, and 284.

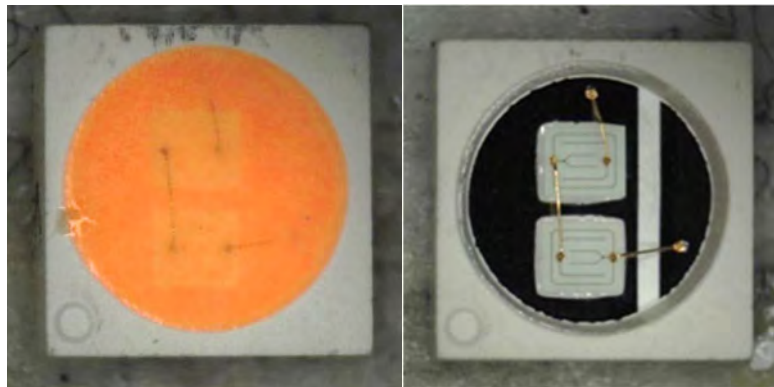
COUNT VII

INFRINGEMENT OF THE '919 PATENT

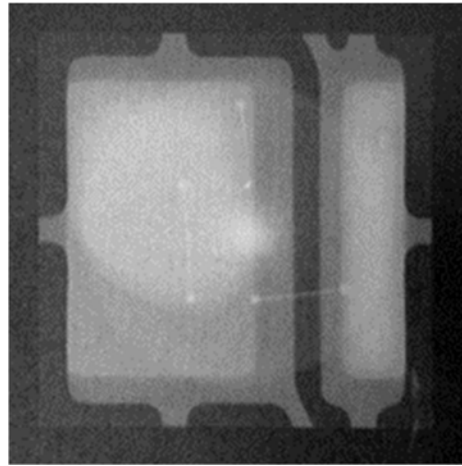
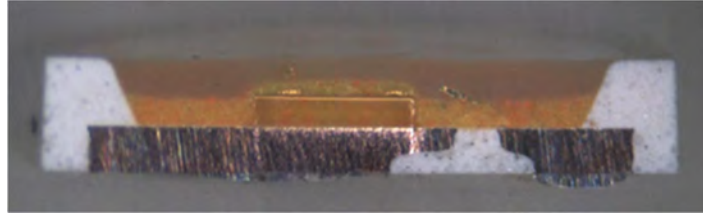
EXAMPLE CLAIM 1

81. Satco has infringed and continues to infringe one or more claims of the '919 patent, including but not limited to claim 1, pursuant to 35 U.S.C. § 271(a) at least by without authority offering to sell and/or selling the S9440 lamp within the United States or importing the S9440 lamp into the United States.

82. The S9440 lamp includes a plurality of LED packages. Optical microscope images of an LED package from an S9440 lamp are reproduced below before and after removal of an encapsulant.



83. The top image below is an optical microscope image of a cross-section through the LED package. The bottom image below is an x-ray through the package.



84. As the above images show, the LED package contains two metal leads spaced apart from each other. A body, which appears as a white material in the optical images above, includes a base that at least partially surrounds the side surfaces of the leads and also fills the separation between the leads. The body is substantially transparent to x-rays and therefore appears relatively dark compared to the metal leads. One of the two LEDs is shown in the optical cross-section as disposed in a cavity in the upper surface of the body. The sides of the cavity comprise a reflector disposed on the base that surround the cavity.

85. As shown in the optical and x-ray images above, the central portion of both leads comprises a relatively thick region that extends up from the bottom of the package. The thick portions appear lighter in the x-ray image. The images further show portions of both leads that comprise relatively thin portions, which appear slightly darker in the x-ray image. The inner

brighter regions indicate the outlines of the claimed first and second bottom leads. The outer slightly darker regions indicate the outlines of the claimed first and second top leads.

86. The optical image above left and the x-ray image above right both show the separation region between the two leads. The separation region between the first and second top leads has a different shape than the separation region between the first and second bottom leads. In addition, as the x-ray image shows, the separation region between the first and second top leads includes two bends.

87. Drawing an imaginary line to bisect the leads in half (*i.e.*, laterally across the x-ray image above right) results in lead halves having equal longitudinal dimensions, but with asymmetrical shapes.

88. Satco's infringement has caused and is continuing to cause damage and irreparable injury to Plaintiffs. Plaintiffs will continue to suffer damage and irreparable injury unless and until that infringement is enjoined by this Court, as a remedy at law alone would be inadequate.

89. Plaintiffs are entitled to injunctive relief and damages in accordance with 35 U.S.C. §§ 271, 281, 283, and 284.

COUNT VIII

INFRINGEMENT OF THE '967 PATENT

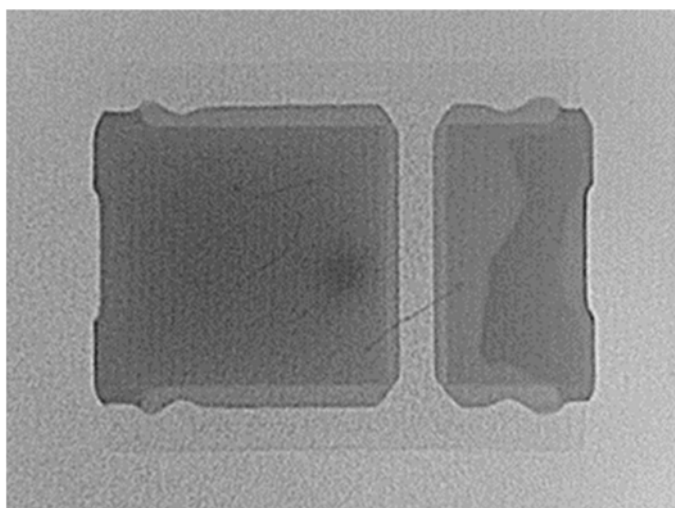
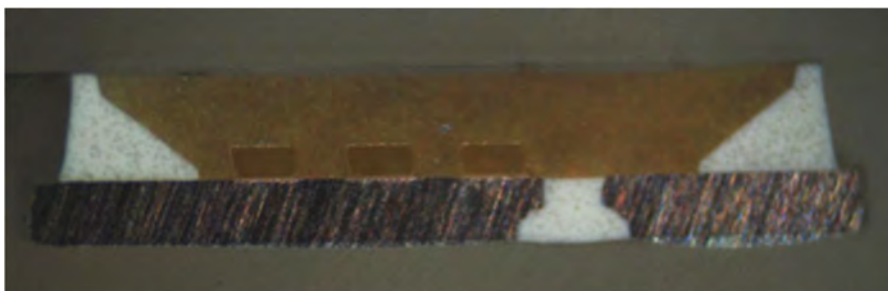
EXAMPLE CLAIM 1

90. Satco has infringed and continues to infringe one or more claims of the '967 patent, including but not limited to claim 1, pursuant to 35 U.S.C. § 271(a) at least by without authority offering to sell and/or selling the S9386 lamp within the United States or importing the S9386 lamp into the United States.

91. The S9386 lamp includes a plurality of LED packages. Optical microscope images of an LED package from an S9386 lamp are reproduced below before and after removal of an encapsulant.



92. The top image below is an optical microscope image of a cross-section through the LED package. The bottom image below is an x-ray through the package.



93. As the above images show, the LED package contains two metal lead frames spaced apart from each other. The optical image shows that each lead frame has a substantially flat top surface, a bottom surface, and sidewalls between the top and bottom surfaces. LED chips are disposed on the top surface of the left lead frame in the optical image.

94. The cross-section image above depict the cross-sectional shape of the sidewalls of both lead frames at the sides that face each other in the horizontal direction. In addition, the upper surface of the left and right lead frames extend further into the space between the lead frames than the bottom surface of the left and right lead frames. That the top surfaces extend further into the space indicates an undercut in the sidewall that partially defines a fixing space between the two lead frames. This same feature is also depicted in the x-ray image above. In particular, both leads are shown with relatively dark inner regions and three sides have relatively light outer regions. The differences in brightness correlate to the thickness of the metal at those locations. The relatively light outer regions correspond to undercut sidewalls on three sides of both lead frames. The undercuts form the fixing space.

95. As discussed above, both lead frames have three undercut sidewalls as indicated by the x-ray images above. Of those three undercut sidewalls, each lead frame has a single sidewall shown as extending vertically in the x-ray image and two sidewalls shown as extending horizontally. The sidewalls extending horizontally in the x-ray image are all parallel and also perpendicular to those shown extending vertically.

96. Satco's infringement has caused and is continuing to cause damage and irreparable injury to Plaintiffs. Plaintiffs will continue to suffer damage and irreparable injury unless and until that infringement is enjoined by this Court, as a remedy at law alone would be inadequate.

97. Plaintiffs are entitled to injunctive relief and damages in accordance with 35 U.S.C. §§ 271, 281, 283, and 284.

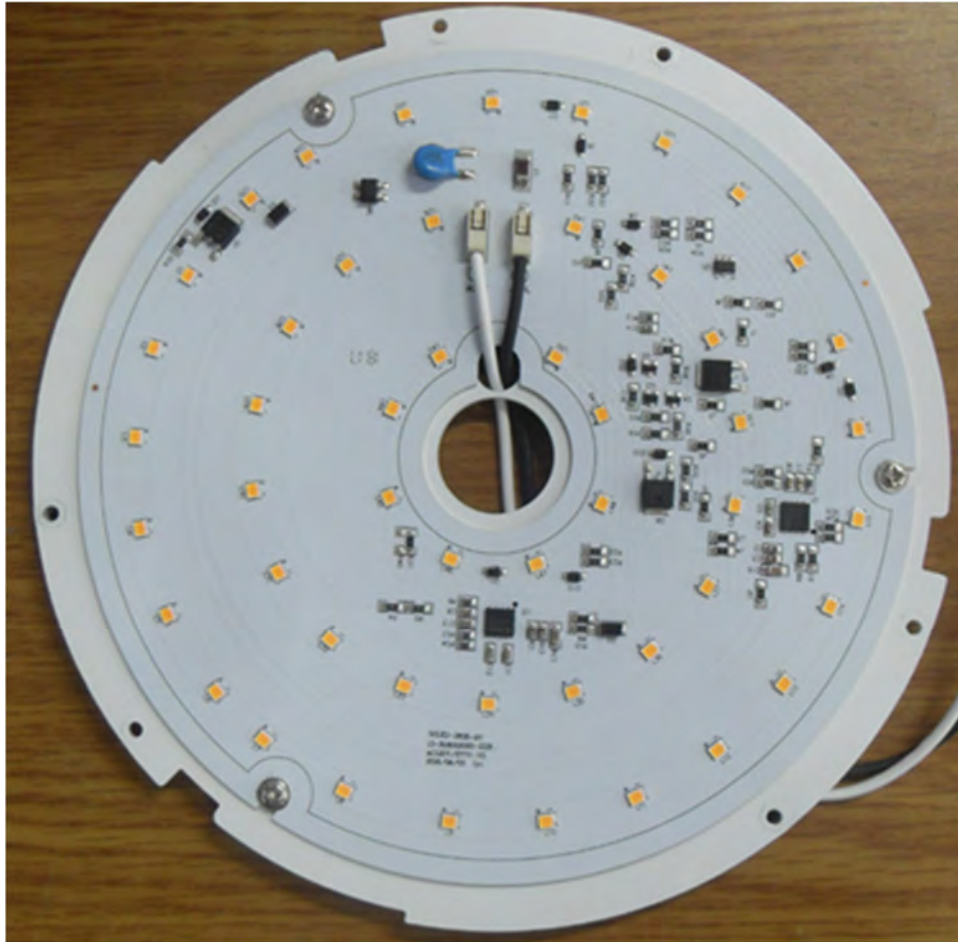
COUNT IX

INFRINGEMENT OF THE '722 PATENT

EXAMPLE CLAIM 15

98. Satco has infringed and continues to infringe one or more claims of the '722 patent, including but not limited to claim 15, pursuant to 35 U.S.C. § 271(a) at least by without authority offering to sell and/or selling the S9782 LED module within the United States or importing the S9782 LED module into the United States.

99. The S9782 LED module includes a plurality of LEDs and the driver circuitry for those LEDs. An optical image of the S9782 LED module is reproduced below. The S9782 LED module includes 50 LED packages labeled L1 through L50, which can be identified based on the yellow encapsulant material in the image below. In addition to the 50 LED packages, the image below also shows the circuit elements that drive the LEDs in multiphase.



100. Among the driver circuitry depicted in the image above are two integrated circuits labeled SW5907, which are AC direct control integrated circuits for LED lighting from Silicon Works. Each SW5907 is connected to a string of 25 LEDs. In addition, each of the SW5907 devices has three output pins used control the operation of three groups of LEDs, the groups having 16, 5, and 4 LEDs. The three groups are connected together in series, with each group having an upstream end and a downstream end. The downstream end of each group is connected to a output pin of its associated SW5907, which selectively connects that path to ground via phase switches. The phase switches are shown in the datasheet for the SW907.

101. Satco's infringement has caused and is continuing to cause damage and irreparable injury to Plaintiffs. Plaintiffs will continue to suffer damage and irreparable injury unless and until that infringement is enjoined by this Court, as a remedy at law alone would be inadequate.

102. Plaintiffs are entitled to injunctive relief and damages in accordance with 35 U.S.C. §§ 271, 281, 283, and 284.

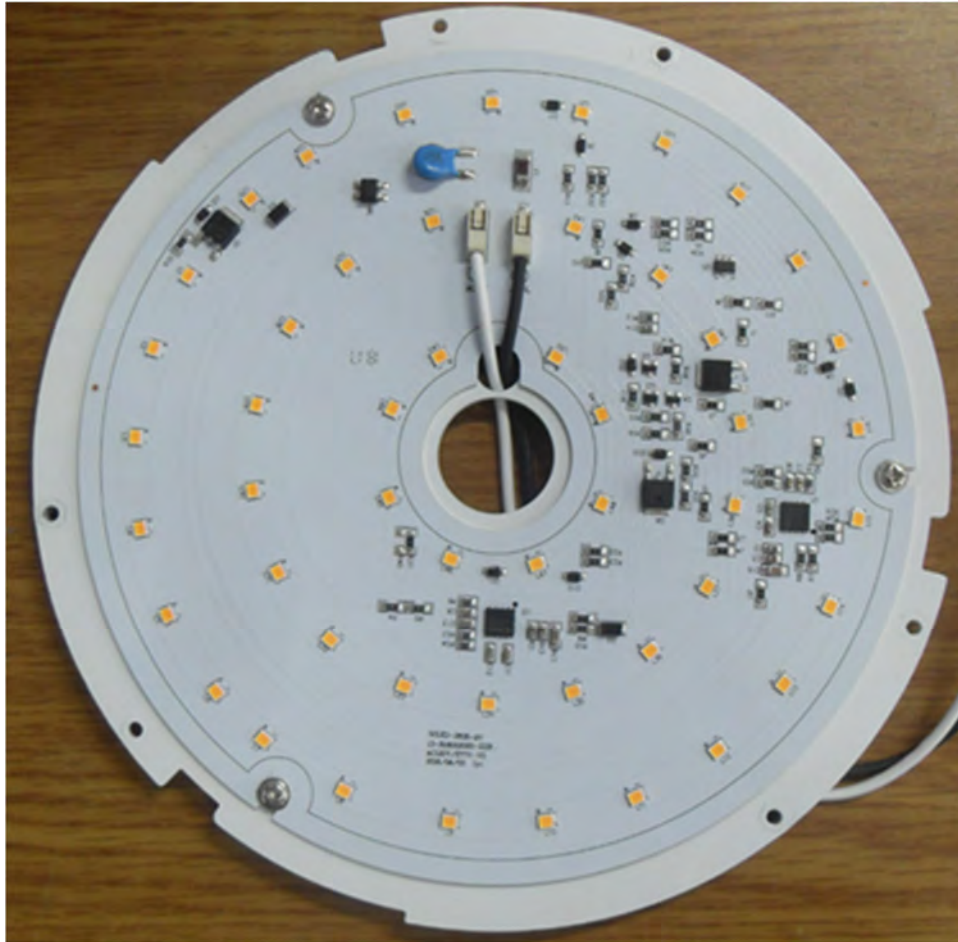
COUNT X

INFRINGEMENT OF THE '828 PATENT

EXAMPLE CLAIM 1

103. Satco has infringed and continues to infringe one or more claims of the '828 patent, including but not limited to claim 1, pursuant to 35 U.S.C. § 271(a) at least by without authority offering to sell and/or selling the S9782 LED module within the United States or importing the S9782 LED module into the United States.

104. The S9782 LED module is an LED lighting apparatus. An optical image of the S9782 LED module is reproduced below. The white and black wires provide alternating current to the module. A circuit element labeled DB1 in the image below is a four-diode rectifying bridge that rectifies the AC voltage received by the module to generate a drive voltage. The S9782 LED module includes 50 LED packages labeled L1 through L50, which can be identified based on the yellow encapsulant material in the image below. In addition to the 50 LED packages, the image below also shows the circuit elements that drive the LEDs.



105. Among the driver circuitry depicted in the image above are two LED driving modules labeled SW5907, which are AC direct control integrated circuits for LED lighting from Silicon Works. The SW5907s are each connected to 25 LEDs. Although each SW5907 has pins for four output channels that provide outputs capable of driving groups of LEDs, the S9782 LED module uses only three of those output channels on each SW5907. The output pins are configured to apply a drive current to groups of LEDs.

106. The specification for the S9782 explains that the module is dimmable. Upon information and belief, the control circuitry for the module compares the detected input to a reference value and block the drive current based on that comparison.

107. Satco's infringement has caused and is continuing to cause damage and irreparable injury to Plaintiffs. Plaintiffs will continue to suffer damage and irreparable injury unless and until that infringement is enjoined by this Court, as a remedy at law alone would be inadequate.

108. Plaintiffs are entitled to injunctive relief and damages in accordance with 35 U.S.C. §§ 271, 281, 283, and 284.

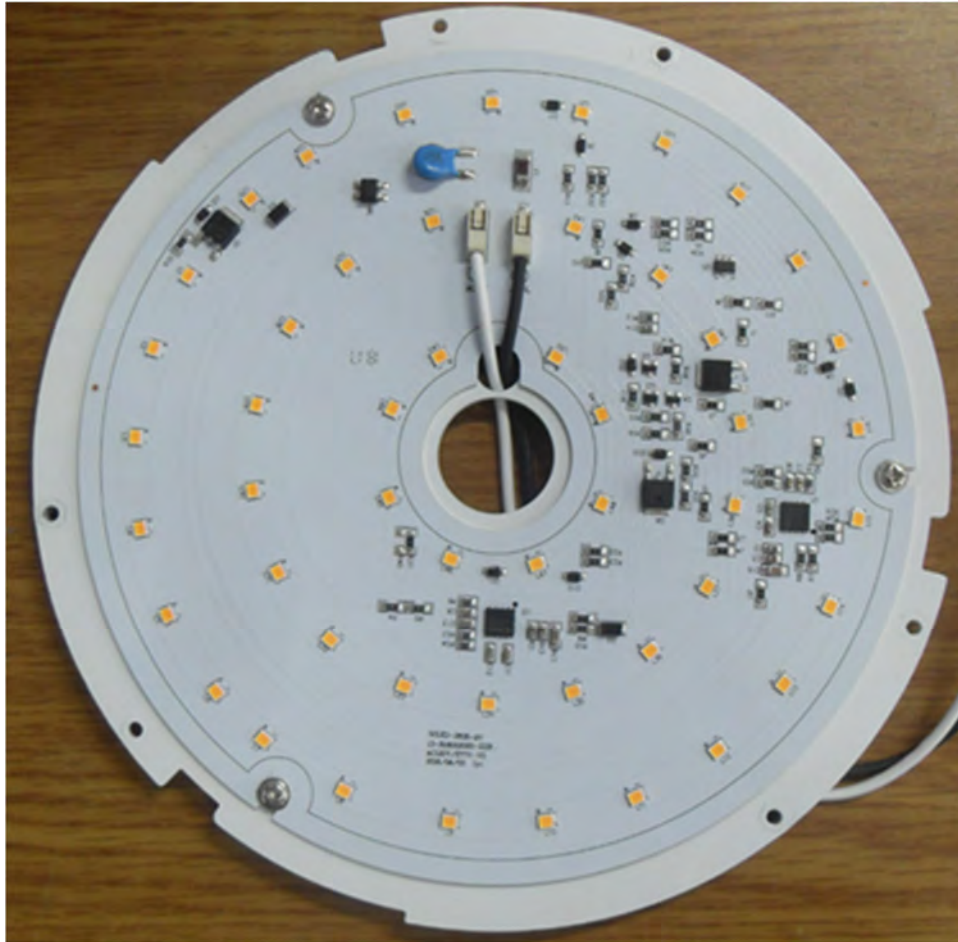
COUNT XI

INFRINGEMENT OF THE '899 PATENT

EXAMPLE CLAIM 14

109. Satco has infringed and continues to infringe one or more claims of the '899 patent, including but not limited to claim 14, pursuant to 35 U.S.C. § 271(a) at least by without authority offering to sell and/or selling the S9782 LED module within the United States or importing the S9782 LED module into the United States.

110. The S9782 LED module is an LED lighting device. An optical image of the S9782 LED module is reproduced below. The S9782 LED module includes 50 LED packages labeled L1 through L50 , which can be identified based on the yellow encapsulant material in the image below. In addition to the 50 LED packages, the image below also shows the circuit elements that drive the LEDs.



111. The 50 LEDs are separated into two sets of 25 LEDs having substantially similar control circuit. Among the control circuitry for each set of 25 LEDs are PTF units that supply driving signals to a subset of the LEDs within the group of 25. One example PTF unit in the S9782 LED is includes a pair of parallel resistors labeled R32 and R33, which are in series with and provide a driving signal to a light emitting unit having 4 LEDs. In operation, the PTF unit supplies a driving signal to its 4 LEDs but not the other 21 LEDs in the set of 25 when the AC voltage input to the PTF is less than the sum of a forward threshold voltage of the other 21 LEDs and the forward threshold voltage of the 4 LEDs.

112. Satco's infringement has caused and is continuing to cause damage and irreparable injury to Plaintiffs. Plaintiffs will continue to suffer damage and irreparable injury unless and until that infringement is enjoined by this Court, as a remedy at law alone would be inadequate.

113. Plaintiffs are entitled to injunctive relief and damages in accordance with 35 U.S.C. §§ 271, 281, 283, and 284.

PRAYER FOR RELIEF

WHEREFORE, Plaintiffs respectfully request that this Court enter judgment in their favor and against Satco as follows:

A. A declaration that Satco has infringed the '946 patent, '631 patent, '331 patent, '435 patent, '210 patent, '225 patent, '919 patent, '967 patent, '722 patent, '828 patent, and '899 patent under 35 U.S.C. § 271, and a final judgment incorporating the same;

B. A declaration that Satco's infringement of at least the '946 patent, the '331 patent, and the '435 patent is willful;

C. A permanent injunction, enjoining Satco and its officers, agents, servants, employees, representatives, successors, and assigns, and all others acting in concert or participation with them from continued infringement under 35 U.S.C. § 271 of the '946 patent, '631 patent, '331 patent, '435 patent, '210 patent, '225 patent, '919 patent, '967 patent, '722 patent, '828 patent, and '899 patent;

D. An award of damages adequate to compensate Plaintiffs for Satco's infringement the '946 patent, '631 patent, '331 patent, '435 patent, '210 patent, '225 patent, '919 patent, '967 patent, '722 patent, '828 patent, and '899 patent together with prejudgment and post-judgment interest and costs pursuant to 35 U.S.C. § 284;

E. An award of enhanced damages for willful infringement;

F. An accounting of all infringing sales and other infringing acts by Satco, and an order compelling an accounting for infringing acts not presented at trial and an award by the Court of additional damages for such acts; and

G. Any other relief to which Plaintiffs are entitled or that the Court seems just and proper.

JURY DEMAND

Pursuant to Rule 38(b) of the Federal Rules of Civil Procedure, Plaintiffs hereby demand trial by jury of all issues so triable.

DATED: April 19, 2019

Respectfully submitted,

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